Effect of Ginger and Cinnamon Intake on Oxidative Stress and Exercise Performance and Body Composition in Iranian Female Athletes

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Original Article

ABSTRACT

Background: Ginger (rich in gingerols and shogaols) rhizomes have been widely used as dietary spices and to treat different diseases in Asia. Cinnamon (containing cinnamic aldehyde and cinnamyl aldehyde) is used as spices and as a pharmacological agent in ancient medicine. Intense exercise can result in oxidative damage to cellular compounds and also muscle soreness. Efficacy of dietary ginger and cinnamon as antioxidant agents and their effectiveness in exercise performance and reducing muscle soreness have been investigated in limited studies on humans. So we studied the effects of dietary ginger and cinnamon on oxidative stress and exercise performance and body composition in Iranian female taekwondo players.

Methods: Sixty healthy trained women, aged 13-25 years, were enrolled in the 6 week investigation and randomly categorized in three groups (cinnamon, ginger, or placebo) and received three grams of ginger, cinnamon, or placebo powder each day depending on the group they belonged. Human malondialdehyde (MDA) level, exercise performance, and body composition were evaluated in the beginning and at the end of the study and compared among the groups.

Results: Forty-nine of the participants completed the 6 weeks intervention. There was minor decrease in MDA in cinnamon and ginger group compared with the placebo group and significant increase in exercise performance in ginger group ($P < 0.01$), and considerable increase in skin fold in cinnamon groups ($P < 0.01$), whereas there were significant accretion in BMI for ginger group ($P < 0.1$) and cinnamon group ($P < 0.05$). No significant changes in MDA, EP, and BMI were observed between groups over time. But there were specific changes in skin fold between cinnamon and placebo group ($P < 0.05$) and cinnamon and ginger groups ($P < 0.05$).

Conclusions: Six weeks administration of ginger and cinnamon in athlete women did not show any significant change in MDA level, body composition, and exercise performance as compared with the placebo group.

Keywords: Cinnamon, exercise, ginger

INTRODUCTION

Ginger -Zingiber officinale is one of the most commonly consumed herbs in traditional medicines like Chinese medicine and other Asian countries.[1] The health-promoting perspective of ginger is often attributed to its rich photochemistry.[2] The ginger rhizome contains about 1-2% of volatile oil and 5-8% of resinous matter, starch, and mucilage.[3]

The volatile oil contains monoterpenes, sesquiterpenes, and sesquiterpene alcohol zingiberol, gingerol, and shagoals. Most of the pharmacologically active constituents reside in the volatile oils.[4]

On the other hand, *Cinnamomum cassia* bark is the outer skin of an evergreen tall tree belonging to the family Lauraceae and have a long history of used as flavoring for most foods, as spices and as a pharmacological agent in ancient medicine.[5] It contains several active components such as essential oils (cinnamic aldehyde and cinnamyl aldehyde), tannin, mucus, and carbohydrate.[6]

Regular physical exercise has many health benefits including reduced risk of cardiovascular disease, cancer, and other diseases.[7] Paradoxically, it is also clear that contracting skeletal muscles produce free radicals and that long term and intense exercise can lead to oxidative damage to cellular compounds and also contribute to muscular fatigue.[8,9] The bioactive molecules of ginger-like gingerols have demonstrated antioxidant activity[10] and increase the energy metabolism and reduce the rate of lipogenesis.[11,12]

In addition, numerous studies indicated that the use of cinnamon provided protection against the oxidative disorder by lowering the human malondialdehyde (MDA) levels and elevating antioxidants enzymes activities[13,14] and improving body composition in association with improved insulin sensitivity[15,16] and There was considerable evidence for substantial positive treatment effects of antioxidants on exercise performance.[17]

Limited data are available regarding the efficacy of dietary ginger and cinnamon as antioxidant activity and their effectiveness in body composition and exercise performance in humans. Therefore we investigated the effects of dietary ginger or cinnamon on oxidative stress and exercise performance and body composition in Iranian female taekwando players.

METHODS

Sixty healthy women trained, aged 13-25 yr, were recruited in the 8 week investigation. Inclusion criteria were exercising three times a week for at least three years. Participants were excluded if they had taken supplements, had a history of any medical condition, or used medication known to affect body metabolism, had any chronic condition that might limit their ability to be involved in the intervention or the existence of pregnancy or lactation. This study was a randomized double blind placebo controlled clinical trial approved by the Isfahan University Committee and Ethics Advisory Committee, and written consent was obtained from all participants. Blood samples were obtained from all subjects 24 hours after specific resistance exercise for the competitive season. Body fat percentage was calculated from triceps skin-fold thickness measurement on the right side of the body by an educated dietician. The skin-fold with the thumbs and index finger of the left hand about 1 cm proximal to the skin fold site was grasped firmly and pulled away from the body, respectively. The caliper which was perpendicular to the long axis of the skin fold and with a faced-up dial was hold in the right hand. The caliper was read 4 seconds after pressure from the measurer's hand had been released from the lever. The measures were recorded 3 times with 10 seconds intervals. It is worth mentioning that measurements were not made immediately after exercise and athletes were asked to seat and relax for around 3 minutes. For functional test, initially, the subjects performed a brief warm-up that consisted of running around the court at low velocity for 5 minutes. Afterwards, agility tests were carried out. The 360 meter run was used to measure the anaerobic power and one must complete the run without any help. The goal was to run the distance as quickly as possible and must run to and through the finish line. Treatment order was determined by an online randomization program (http://www.randomization.com).

In a double-blinded fashion, subjects received 3 grams of oral dietary ginger powder (n = 15) or dietary cinnamon powder (n = 15) or placebo (n = 15) for 8 weeks. All participants were instructed to take the 3 grams of powder during a day and were asked to follow regular diet and record their diet for one day before the first blood sample was drawn at baseline and during

the intervention for 3 times. Diet records were analyzed using the nutritional analysis system. and then the blood samples and skin fold and agility test were measured after intervention, human malondialdehyde (MDA) ELISA Kit was used to assay MDA in the samples of subject' serum.

Statistical analysis

The results are presented as a mean ± standard error. One-way multivariate analysis of covariance (MANCOVA) controlling for the pre-test differences, followed by Dunnett's *post hoc* comparison was used for multiple comparisons between the groups. Within group comparisons were done using paired samples *t*-test. Due to non-normality of the studied variables (positive skewed distribution) logarithmic transformation was done and homogeneity of covariance matrix has been tested via Box'M statistics. Analyses were performed with the SPSS version 16 (SPSS Inc, Chicago, IL) statistical package.

RESULTS

Sixty subjects were enrolled with median (range) of 19 (13-25) years; 49 of them completed the 6 weeks intervention. Exclusion from the study were none-compliance of study. General mean ± SD for all study sample for age (yrs), weight (kg), and body mass index (BMI, kg/m2) was (17.58 ± 3.6), (53.32 ± 8.35), and (20.49 ± 2.94), respectively. Table 1 presents these variables for each studied groups. There are no statistically significant differences between groups in terms of basic characteristics.

Table 1: Basic characteristics of the participants in studied groups

Group	Mean(±SD)
Age	
Control	16.82±0.8
Cinnamon	18.33±1.18
Ginger	
Weight	16.76±0.8
Control	50.78±6.88
Cinnamon	52.13±7.10
Ginger	55.29±9.90
B.M.I	
Control	19.8±0.5
Cinnamon	20.2±0.6
Ginger	21.3±0.97

BMI=Body mass index

Multivariate ANCOVA result showed significant difference among studied groups in terms of study variables (Walk's λ=0.261, F = 3.492; $P < 0.05$).

Mean plasma levels of MDA and average data of exercise performance (EP) and skin fold, before and after intervention is shown in Table 2.

There were minor but not significant decrease (paired *t*-test) in MDA in cinnamon and ginger group compared with the placebo group and significant increase in exercise performance in ginger group ($P < 0.1$), and considerable increase in skin fold in cinnamon groups ($P < 0.01$), whereas there were significant accretion in BMI for ginger group ($P < 0.1$) and cinnamon group ($P < 0.05$).

No significant changes in MDA, EP, and BMI were observed between groups over time. But there was specific changes in skin fold between cinnamon and placebo group ($P < 0.05$) and cinnamon and ginger groups ($P < 0.05$).

DISCUSSION

The purpose of the current study was to examine the acute effects of oral consumption of a 3-g dose of ginger or cinnamon on plasma levels of MDA and body composition and exercise performance for 6-weeks in female martial athletes. Our findings indicate that there were minor but not significant decreases (paired *t*-test) in MDA in cinnamon and ginger group compared with the placebo group, and significant increase in exercise performance in ginger group and in skin fold in cinnamon groups, whereas there were significant accretion in BMI for ginger and cinnamon groups. These results are inconsistent with previous studies[10,13,18-20] demonstrating that a certain dose of ginger or cinnamon can reduce plasma levels of MDA compared with the healthy control group, although there was a slight but not significant decrease for ginger group during study. Also, its supported that the inclusion of cinnamon or ginger compounds in the diet could improve body composition,[11,15,16] but we uncover increasing in the BMI and skin fold for both group, however, increase in the exercise performance in ginger group like other antioxidants was consistent with previous study.[17,19,21,22] It is possible that ginger did not exhibit lowering effects in the oxidative stress in current study because the dose was insufficient and effects were related

Table 2: Plasma concentrations of oxidative stress marker and exercise Performance (EP) and skin fold, before and after ingestion of placebo (Q), ginger (G), cinnamon (C)

Group	MDA		EP		Skin fold		BMI	
	(Mean±SE)	*P* value	(Mean±SE)	*P* value	(Mean±SE)	*P* value	(Mean±SE)	*P* value
Q								
Pre	54.31±14.99		10.88±0.62		20.49±3.85		20.15±2.59	
Post	56.82±22.74	1.00*	10.82±0.98	0.547*	19.11±4.80	0.681*	20.00±3.44	1.00*
	t=0.212 (P=0.834)		t= -.485 (P=0.634)		t=-2.189 (P<0.05)		t=-0.27 (P=0.78)	
C								
Pre	72.1±85		10.71±0.53		17.55±33		19.7±2.6	
Post	76.5±87	1.00**	10.64±0.90	1.00**	19.73±3.1	0.004**	20.19±2.6	0.828**
	t=-4.68 (P=0.647)		t=2.10 (P=0.23)		T=2.94 (P<0.01)		t=2.9 (P<0.05)	
G								
Pre	62.5±115		10.8±0.93		20.17±4.60		21.25±3.20	
Post	45.4±45	1.00***	10.99±0.93	0.33***	19.99±5.27	0.013***	21.49±3.20	1.00***
	t=-0.91(P=0.37)		t=-1.9 (P<0.1)		T=-0.25 (P=0.80)		t=2.171 (P<0.1)	

*significant differences between Q and G, **significant differences between C and Q, ***significant differences between G and C, MDA=Malondialdehyde, EP=Exercise performance, BMI=Body mass index

to ginger dose for body weight or the duration of the assessment did not allow adequate time for the ginger to act as antioxidant and improve the performance for cinnamon group. Since the beginning of this study coincided with the start of the competitions and the end of the study was consistent with the recovery phase, so BMI and skin fold increased during the study.

The effects of receiving ginger and cinnamon were investigated in one study together and this was one of the strength points of the present study. A few human studies have evaluated the effects of receiving ginger and cinnamon on lipid peroxidatin. This investigation is one of the limited studies which accessed antioxidant properties of cinnamon and ginger besides body composition and exercise performance.

CONCLUSION

It is possible that ginger did not exhibit lowering effects in the oxidative stress in current study because the dose was insufficient and effects were related to ginger dose for body weight or the duration of the assessment did not allow adequate time for the ginger to act as antioxidant and improve the performance for cinnamon group. Since the beginning of this study coincided with the start of the competitions and the end of the study was consistent with the recovery phase, so BMI and skin fold increased during the study.

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